WE CLAIM:

1. A method for sensing toner concentration in a developer housing with an optical system containing developer material comprising toner and carrier, the method, comprising:

emitting light with the optical system through a viewing window in the developer housing onto developer material in said housing;

sensing the light reflected off said developer material with the optical system;

calculating a toner concentration measurement based upon the sensed light reflected off said developer material; and

compensating the toner concentration measurement to account for optical variation due to the developer material condition.

2. The method of claim 1, wherein said compensating includes determining a carrier age of the developer material; and correlating the carrier age to a carrier age correction factor.

3. The method of claim 1, wherein said compensating includes determining an impaction of the developer material; and correlating the impaction to an impaction correction factor.

4. The method of claim 1, wherein said compensating includes determining a carrier age of the developer material; correlating the carrier age to a carrier age correction factor; determining an impaction of the developer material; and correlating the impaction to an impaction correction factor.

5. The method of claim 4, wherein said calculating includes determining toner concentration with the following equation

$$TC_{meas} = \frac{1}{\Delta C' / \Delta TC}(C'_{meas} - C'_0) + TC_0$$

where C'_{meas} is the measured chroma value and the pair C_0, TC_0 are the initial chroma and TC values, respectively, determined at calibration.

6. The method of claim 5, wherein said determining includes calculating effects of impaction, with the following equation:

$$\overline{TC}_{meas}(k) = TC_{meas}(k) + \delta(k),$$

where k is the measurement index, □ is the correction factor, $\overline{TC}_{meas}$ is the corrected TC value, and TC_{meas} is the measured TC value, said correction factor, □, is computed as

$$\delta(k) = \alpha(I(k) - I_0),$$

where α is the correction gain (in units of %TC/(mg/g)), I refers to the level of impaction (mg/g), and I_0 is the level of impaction in fresh developer (mg/g).

7. The method of claim 6, wherein said determining includes calculating effects of carrier age with the following equation:

$$I(k) = \theta_1 - \theta_2 \exp(-CA(k)/\theta_3),$$

(4)

where CA is the carrier age and the model parameters, θ_1, θ_2, and θ_3.

8. The method of claim 7, further comprising determining carrier age with the following equation:

$$CA(k) = (1-\gamma)(CA(k-1)+T),$$

where T is the TC sampling time and $\gamma \in (0,1)$ is the fraction of carrier mass that is "trickled" out of the housing at each sample time, at each sample time, denoted by *k*.

9. In an electrographic printing having a method for sensing toner concentration in a developer housing with an optical system containing developer material comprising toner and carrier, the method, comprising:

emitting light with the optical system through a viewing window in the developer housing onto developer material in said housing;

sensing the light reflected off said developer material with the optical system;

calculating a toner concentration measurement based upon the sensed light reflected off said developer material; and

compensating the toner concentration measurement to account for optical variation due to the developer material condition.

10. In an electrographic printing having the method of claim 9, wherein said compensating includes determining a carrier age of the developer material; and correlating the carrier age to a carrier age correction factor.

11. In an electrographic printing having the method of claim 9, wherein said compensating includes determining an impaction of the developer material; and correlating the impaction to an impaction correction factor.

12. In an electrographic printing having the method of claim 9, wherein said compensating includes determining a carrier age of the developer material; correlating the carrier age to a carrier age correction factor; determining an impaction of the developer material; and correlating the impaction to an impaction correction factor.

13. In an electrographic printing having the method of claim 12, wherein said calculating includes determining toner concentration with the following equation:

$$TC_{meas} = \frac{1}{\Delta C' / \Delta TC}(C'_{meas} - C'_0) + TC_0$$

where C'_{meas} is the measured chroma value and the pair C_0, TC_0 are the initial chroma and TC values, respectively, determined at calibration.

14. The method of claim 13, wherein said determining includes calculating effects of impaction, with the following equation:

$$\overline{TC}_{meas}(k) = TC_{meas}(k) + \delta(k),$$

where k is the measurement index, □ is the correction factor, $\overline{TC}_{meas}$ is the corrected TC value, and TC_{meas} is the measured TC value, said correction factor, □, is computed as

$$\delta(k) = \alpha(I(k) - I_0),$$

where α is the correction gain (in units of %TC/(mg/g)), I refers to the level of impaction (mg/g), and I_0 is the level of impaction in fresh developer (mg/g).

15. The method of claim 14, wherein said determining includes calculating effects of toner age with the following equation:

$$I(k) = \theta_1 - \theta_2 \exp(-CA(k)/\theta_3),$$

(4)

where CA is the carrier age and the model parameters, θ_1, θ_2, and θ_3.

16. The method of claim 15, further comprising determining carrier age with the following equation:

$$CA(k) = (1-\gamma)(CA(k-1)+T),$$

where T is the TC sampling time and $\gamma \in (0,1)$ is the fraction of carrier mass that is "trickled" out of the housing at each sample time, at each sample time, denoted by k.